

MAP4C - Dec 2014

NAME: \_\_\_\_\_

Unit 3 Test

Expectation	Level Achieved
A1 - evaluate powers with rational exponents, simplify algebraic expressions involving exponents, and solve problems involving exponential equations graphically and using common bases;	
A2 - describe trends based on the interpretation of graphs, compare graphs using initial conditions and rates of change, and solve problems by modelling relationships graphically and algebraically;	
A3 - make connections between formulas and linear, quadratic, and exponential relations, solve problems using formulas arising from real-world applications, and describe applications of mathematical modelling in various occupations.	

Expectation A1

1) Solve for:

a)  $y = mx + r$

b)  $V = \frac{4}{3}\pi r^3$

c)  $I = Prt$

$y - mx = r$   
 $\frac{V}{\frac{4}{3}\pi} = r^3$   
 $\frac{3V}{4\pi} = r^3$   
 $\sqrt[3]{\frac{3V}{4\pi}} = r$   
 $\frac{I}{P \cdot t} = r$

2) Evaluate each of the following. SHOW YOUR WORK. Where appropriate, express answers in fraction form. Decimal equivalents will not be accepted.

a)  $(-4)^{-2}$

b)  $\left(\frac{3}{4}\right)^{-3}$

c)  $\left(-\frac{1}{2}\right)^{-3}$

$(-4)^{-2} = \frac{1}{(-4)^2} = \frac{1}{16}$   
 $\left(\frac{3}{4}\right)^{-3} = \left(\frac{4}{3}\right)^3 = \frac{4^3}{3^3} = \frac{64}{27}$   
 $\left(-\frac{1}{2}\right)^{-3} = (-2)^3 = -8$

d)  $-8^{-\frac{1}{3}}$

e)  $\left(\frac{9}{4}\right)^{\frac{3}{2}}$

f)  $5^{-\frac{1}{3}} \times 5^{-\frac{2}{3}}$

$-8^{-\frac{1}{3}} = \frac{1}{(-8)^{\frac{1}{3}}} = \frac{1}{\sqrt[3]{-8}} = \frac{1}{-2} = -\frac{1}{2}$   
 $\left(\frac{9}{4}\right)^{\frac{3}{2}} = \left(\sqrt{\frac{9}{4}}\right)^3 = \left(\frac{3}{2}\right)^3 = \frac{27}{8}$   
 $5^{-\frac{1}{3}} \times 5^{-\frac{2}{3}} = 5^{-\frac{1}{3} - \frac{2}{3}} = 5^{-1} = \frac{1}{5}$   
 $S = \frac{\pi p h^2}{7}$

$3V = \pi r^2 h$   
 $\frac{3V}{\pi h} = r^2$   
 $\sqrt{\frac{3V}{\pi h}} = r$   
 $V = \frac{b^2 h}{3}$   
 $3V = b^2 h$   
 $\frac{3V}{h} = b^2$   
 $\sqrt{\frac{3V}{h}} = b$

$\sqrt{\frac{3V}{h}} = b$   
 $\sqrt{\frac{3V}{h}} = b$   
Opposites

$\begin{matrix} + & - \\ - & + \\ \times & \div \\ \div & \times \end{matrix}$   
 $\begin{matrix} 2 & \sqrt{\phantom{x}} \\ 3 & \sqrt[3]{\phantom{x}} \\ 6 & \sqrt[6]{\phantom{x}} \end{matrix}$

3) Simplify each of the following expressions. [Hint: Use your exponent rules]

a)  $(5x^5)(4x^{-3}) =$

$$20x^2$$

b)  $\frac{24x^6y}{-8x^{-2}y} =$

$$\begin{aligned}
 & -3x^{6-(-2)}y^{1-1} \\
 & -3x^8y^0 \\
 & -3x^8
 \end{aligned}$$

c)  $(-2c^2)^3 =$

$$\begin{aligned}
 & (-2)^3 c^{2(3)} \\
 & -8c^6
 \end{aligned}$$

d)  $\frac{(5xy^2)(4x^2y^{-3})}{20x^3y^{-2}} =$

$$\begin{aligned}
 & \frac{(25x^3y^4)(4x^2y^{-3})}{20x^3y^{-2}} \\
 & \frac{100x^5y^1}{20x^3y^{-2}} = 5x^2y^3
 \end{aligned}$$

e)  $\sqrt[3]{\sqrt{x^6}}$

$$= (\sqrt[3]{x^6})^{1/3}$$

$$= (x^{6/2})^{1/3}$$

$$= (x^3)^{1/3}$$

$$= x^{3/3}$$

$$= x^1$$

$$= x$$

4) Solve for x:

a)  $2^{2x+1} = 128$

$$\begin{aligned}
 & \boxed{2}^{\boxed{2x+1}} = \boxed{2}^{\boxed{7}} \\
 & 2x+1 = 7 \\
 & 2x = 7-1 \\
 & 2x = 6 \\
 & x = 3
 \end{aligned}$$

f)  $(-6m^{-4}n^2) \div (2m^{-1}n^{-6})$

$$= -3m^{-4-(-1)}n^{2-(-6)}$$

$$= -3m^{-3}n^8$$

$$= \frac{-3n^8}{m^3}$$

b)  $3^{2x+1} = 27^{x-3}$

$$3^{2x+1} = (3^3)^{x-3}$$

$$3^{2x+1} = 3^{3x-9}$$

$$2x+1 = 3x-9$$

$$1+9 = 3x-2x$$

$$10 = 1x$$

$$\begin{aligned}
 & 2x+1 = 3x-9 \\
 & 2x-3x = -9-1 \\
 & -x = -10 \\
 & x = 10
 \end{aligned}$$

## Expectation A2

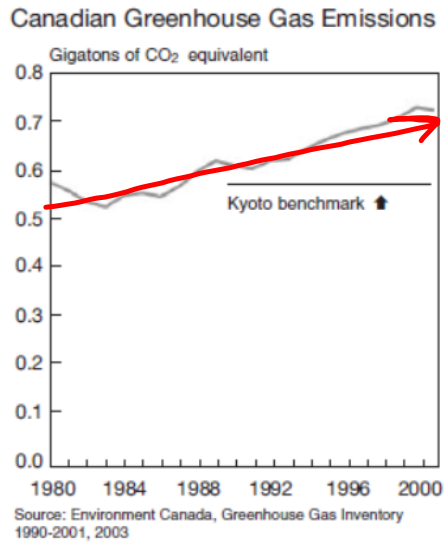
5) Fill in the following chart

Equation	Does this represent Exponential Growth or Exponential Decay	What is the initial value or (y-intercept)	What is the Growth Factor or Rate of Decay
$V = 100(1.08)^t$	G	100	8%
$P = 32(0.95)^n$	D	32	5%
$A = 5(3)^x$	G	5	200%
$Q = 600\left(\frac{5}{8}\right)^n$	D	600	$\frac{3}{8}$

6) Classify each of the following as linear, quadratic, or exponential.

- a) A \$125 fine is increased by 7% for each month that it remains unpaid. E
- b) A \$125 fine is increased by \$12.50 for each month that it remains unpaid. L
- c)  $y = 6x^2 + 5$  Q
- d) Jason earns \$7.85/h L
- e)  $P = 250(3.88)^x$  E
- f)  $y = 4x - 3$  L

7) Given the following graph, describe the trend in Canadian greenhouse gas emissions over the time period shown. Describe some factors that may have influenced these emissions over time. Predict the emissions today, explain your prediction using the graph.



As years pass,  
green house gas ↑  
- population ↑

### Expectation A3

8) The value of a car after it is purchased depreciates according to the formula  $V = 28000(0.875)^n$  where  $V$  is the car's value in the  $n$ th year since it was purchased.

- a) What is the purchase price of the car?

\$28000

- b) What is the annual rate of depreciation?

$$1 - 0.875 = 0.125 \quad 12.5\%$$

- c) What is the car's value at the end of 4 years?

$$V = 28000(0.875)^4$$

- d) What is the car's value at the end of 30 months?

$$V = 28000(0.875)^{2.5}$$

9) There are currently 162 ants in an anthill. However, the number of ants in the hill is tripling every month.

- a) Write an equation to model this situation.

$$y = 162(3)^n$$

- b) How many ants will there be in this colony after 1 year? (*very large number*)

$$y = 162(3)^{12}$$

- c) How many ants were in this colony four months ago?

$$y = 162(3)^{-4}$$